

Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE.

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(*HELMINTHOPHILA LEUCOBRONCHIALIS*)

A HYBRID BETWEEN

THE GOLDEN-WINGED WARBLER (*HELMINTHOPHILA CHRYSOPTERA*)

AND

THE BLUE-WINGED WARBLER (*HELMINTHOPHILA PINUS*).

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BREWSTER'S WARBLER (*HELMINTHOPHILA LEUCOBRONCHIALIS*) A HYBRID BETWEEN THE GOLDEN-WINGED WARBLER (*HELMINTHOPHILA CHRYSOPTERA*) AND THE BLUE-WINGED WARBLER (*HELMINTHOPHILA PINUS*).

THE real nature of Brewster's Warbler has long been a moot point with ornithologists. Is it a true species, a mongrel, a color-phase of the Blue-winged Warbler, or an atavistic form of the Golden-winged Warbler? Each of the four propositions implied in this question has found advocates among the various authors who have written on the topic, but until now no indubitable proof of the true status of this bird has been obtained.

In January, 1911, I published a paper bearing on this subject, in the *Memoirs of the Museum of Comparative Zoölogy*, 40, no. 2; I will here give a *résumé* of the facts recorded in it, a course which seems desirable because these facts were misstated by the reviewer of my article, in *The Auk* for April, 1911.

In the summer of 1910, there bred within the confines of a swamp of about fifteen acres in Lexington, Mass., a pair of Golden-winged Warblers, and two male Golden-winged Warblers mated with two female Brewster's Warblers. In the same swamp there was also a male Brewster's Warbler that unquestionably was unmated. The progeny of the three pairs were closely observed from the juvenile (in one case, from the natal) plumage up to the first winter plumage, when the adult characters were acquired; the young of the pair of Golden-wings were all Golden-wings; one of the Brewster's Warblers that was mated with a Golden-wing brought forth a homogeneous brood of Brewster's Warblers, while the other produced a mixed brood of Brewster's Warblers and at least one Golden-winged Warbler. A striking thing about it was this: the young birds of mixed parentage were absolutely pure in plumage,—either Brewster's Warblers or Golden-wings, without any tendency to combine, as "intermediates," the characters of the two parents. They appeared to exemplify the transmission of characters in accordance with Mendel's Law, and from that time I had little doubt that Brewster's Warbler itself would prove to be a result of the union

of the Golden-winged Warbler and the Blue-winged Warbler,— a Mendelian so-called dominant hybrid, as Mr. J. T. Nichols suggested in *The Auk*, Jan., 1908, 25, p. 86.

Since my memoir was published, Golden-winged Warblers and Brewster's Warblers have bred every year in the Lexington swamp. In 1911 Dr. W. M. Tyler and I devoted a good deal of time to them, but without any very definite results. There were during that season at least one male Brewster's Warbler, and one female Brewster's Warbler, together with approximately three male and three female Golden-wings; both Golden-wings and Brewster's Warblers were reared by these birds, but unfortunately we failed that summer to discover how the old birds were paired off.

In the summer of 1912 I lived so far away from Lexington that I was unable to pursue the study of this interesting little colony of birds to any advantage. However, in a visit to the place on the 27th of May, I found a male Brewster's Warbler in song,¹ and on the 4th of July Dr. Tyler saw a male Golden-wing and a female Brewster's Warbler feeding a brood of young birds, one at least of which was a young Brewster's Warbler, while in another part of the swamp he met with a female Golden-wing with a brood containing Golden-wings and Brewster's Warblers assuming their first winter plumage.

In the spring of 1913 I resumed my residence in Lexington and, in association with Dr. Tyler, continued the study of the Warbler colony. The Golden-winged Warbler arrived this year on the 6th of May, a rather early date for this species.² The population of the swamp, so far as the birds were concerned in whom we were especially interested, consisted of a male Golden-wing, a female Golden-wing, a male Brewster's Warbler, and a female Blue-winged Warbler. The male Golden-wing was mated with the female Blue-wing, the male Brewster's Warbler with the female Golden-wing. No nests were found, and the manner in which the birds were paired off together was not determined till the young birds had left the nests; in fact neither of the females was seen until then, about the middle of June. All of the old birds were perfectly typical in plumage, the male *leucobronchialis* being one of the pure-plumaged specimens that show not the faintest trace of yellow on the under parts. Here at last we had the combination we had so ardently wished for, but hardly hoped to find,— the Golden-wing mated with the Blue-wing,— and we now followed with keen inter-

¹ I take this opportunity to record another male Brewster's Warbler which I saw in full song near Walden Pond, Concord, Mass., on May 19, 1912.

² The average date of arrival of this bird in the neighborhood of Boston, based on my records for 24 years, is May 11. The earliest date within that period is May 3, 1905, the latest May 15, 1908.

est the growth of the young of this pair in their slow progress from the nestling plumage to the first winter plumage. When first seen, on the 15th of June, these young birds were probably not more than two days out of the nest, and both Dr. Tyler and myself saw, or thought we saw, a deeper yellow tint on their breasts and bellies than we had hitherto seen on young *chrysopterae* and *leucobronchiales* of the same age; by the 20th of June, however, this yellow tinge was much less pronounced, and by the 25th of the month, when the tails of the little birds were about three quarters of their full length, the yellow was scarcely apparent, the young still wearing the juvenile dress. Dr. Tyler had fastened a platinum band on the leg of one of the little birds of this family on the 15th of June; we were thus enabled to note the change of color in the same individual as the days wore on,—a change doubtless due to the loss of the fugacious, veiling, yellow tips of the juvenile feathers.

On the 27th of June we saw the first signs of the post-juvenile moult in the loss of one set of wing-coverts with its yellowish bar. By the first of July the contour feathers of the juvenile plumage were being extensively replaced by those of the first winter plumage. As in former seasons (1910, 1911) a marked difference was apparent in the amount of yellow on the under parts of the different individuals of the same brood. In at least one of the brood now under consideration the yellow tint was very faint and it was clear even at this early date that this young one was a *leucobronchialis*; in other members of this same brood the second winter plumage displayed a strong yellow tint on the throat and along each side of the breast and belly, following the area of the *pteryla ventralis* and leaving an ash-colored longitudinal band along the median line of the abdomen, caused by the retention of some of the juvenile set of feathers. As time went on, the yellow color gradually became fainter and restricted for the most part to the breast, leaving the throat and abdomen ashy white; the growth of a black trans-ocular stripe and yellow wing-coverts now perfected the garb of *Helminthophila leucobronchialis*. On the 12th of July at least two of this brood of young birds were as slightly tinged with yellow as the young *leucobronchialis* figured on the plate of my memoir of 1911 (fig. 1). Not one of this brood developed the least trace of the black throat and broad cheek-patch of *H. chrysoptera*.

As I have previously said, the varying amount of yellow, at the same date, in different young Brewster's Warblers of the same brood was noticeable in all of the years in which we observed the growth of the winter plumage in these birds. This may be the result of different degrees of precocity in the individ-

uals composing the brood, or it may be connected with sex, since the female of Brewster's Warbler, I think, always retains a tinge of yellow on the breast, even in the adult. I fancy the rapid loss of the veiling yellow feather-tips is occasioned by their disintegration and dropping off rather than by mere mechanical abrasion and bleaching.

When the female *pinus* was first observed, although she was a typical *pinus* in plumage, both Dr. Tyler and I surmised that she was a so-called impure *pinus* in blood, produced in accordance with the Law of Mendel from one of the many crossings of *chrysoptera* with *leucobronchialis* that, to our personal knowledge, have occurred in this locality during the last four years; in other words, that she belonged to the same family stock as the *chrysopterae* and *leucobronchiales* in the swamp. We even calculated, with lively anticipation, the chances of seeing a Lawrence's Warbler among her offspring,—a more than even chance provided both she and her Golden-winged mate belonged to the mixed stock and raised a brood of four or five young. This expectation (like many a hope staked on young promise for its fulfilment) was not realized; all the young birds grew up to be Brewster's Warblers; yet we had the full satisfaction of demonstrating the true nature of Brewster's Warbler and removing the question forever from the realm of conjecture. That all of the offspring of this pair of birds were Brewster's Warblers would indicate that both of the parents were of pure blood. By the Mendelian Law of transmission a pure *chrysoptera* mated with a pure *pinus* should produce nothing but *leucobronchiales*; a pure *chrysoptera* and an impure *pinus* will produce, on the average, *chrysopterae* and *leucobronchiales* in equal numbers; an impure *chrysoptera* and a pure *pinus*, in like manner, *pinus* and *leucobronchiales* in the same proportion; while an impure *chrysoptera* united with an impure *pinus* would give rise to *chrysopterae*, *pinus*, *leucobronchiales*, and *lawrencei* in equal proportions.

It is interesting to recall to mind in this connection, that Dr. Tyler saw a male Blue-winged Warbler near his house on the 6th of May of this year (Auk, July, 1913, **30**, p. 435); this bird sang the normal song of the Blue-winged Warbler,—pretty sure evidence that he was a stranger from the South and not a member of the native Lexington colony of mixed breed, all of whom without exception sing the Golden-wing's song. It is highly probable that on the night of the 5th–6th of May, when there was a heavy migration of Warblers in this region, a small flight of Blue-winged Warblers invaded eastern Massachusetts and that the female Blue-wing that mated with the Golden-wing in the Lexington swamp came in with that flight.

The history of the other pair in the swamp, a male Brewster's Warbler and a female Golden-wing, may be told in a few words. As in one of the two cases of a male Golden-wing joined with a female Brewster's Warbler, considered in detail in my memoir published in 1911, a majority of their issue were Brewster's Warblers, but one of them a male Golden-wing. Dr. Tyler banded two of the little birds belonging to this brood on the 19th of June, when they were but a day or two out of the nest and as like each other as two peas from one pod; one of these grew up to be a typical Brewster's Warbler while the other, its own brother, became a typical male Golden-wing. If any of the birds that were banded (three in all) return and breed in their native place next summer, we may be able to establish a family pedigree for these interesting hybrids, extending through three generations, complete as regards both the male and the female lines.

In my paper published in 1911, after stating the different hypotheses proposed in order to explain the relations existing among the Golden-winged, Blue-winged, Brewster's, and Lawrence's Warblers I added, half in jest, that the only hypothesis left for a new-comer in the field was this: that the Golden-winged and the Blue-winged Warblers themselves were merely two forms of one species. Curiously enough, not long after this I found that this very opinion had been expressed, and in a most unexpected quarter: in a letter dated Edinburgh, Sept. 15, 1835, Audubon wrote to Bachman that he suspected the Golden-winged Warbler and the Blue-winged Warbler were one species!¹ That Audubon at that early date, ignorant (as he was assumed to be) of the existence of Brewster's and Lawrence's Warblers, and but superficially acquainted with the Golden-wing, should suspect that two birds so diverse as the Blue-wing and the Golden-wing were one species seemed incomprehensible, and in the light of what we now know about these birds, his surmise seemed to presuppose an almost superhuman faculty of prevision.

As a possible explanation of Audubon's letter I have only this to offer: in the winter of 1876-77 Dr. Spencer Trotter² discovered in the collection of the Academy of Natural Sciences of Philadelphia a specimen of Brewster's Warbler without a label, the third specimen known up to that time; on the bottom of

¹This letter is among the many unpublished MS. letters of Audubon in the Wade collection, generously presented to this Museum by Mr. John E. Thayer.

²See Proc. Acad. Nat. Sci. Phila. for 1877, Jan. 1, 1878, p. 292; Bull. Nuttall Ornithol. Club, Jan., 1878, 3, p. 44, Jan., 1879, 4, p. 59.

the stand was written in the autograph of John Cassin, "J. C., 20 October, 1862", and also a badly blurred legend "Not [note?] from Bell." An appeal to J. G. Bell elicited the response that he remembered shooting a peculiar Warbler in Rockland Co., N. Y., about the year 1832,— a Warbler something like a Golden-wing, but lacking, although in high plumage, the black throat of that species; a great many years afterward, he sold this specimen in Philadelphia but knew nothing of its ultimate fate. Dr. Trotter justly inferred that the Philadelphia Academy specimen was in all probability the very bird shot by Bell.

Now as Audubon was intimately associated with Bell, is it not possible that he had examined this example of Brewster's Warbler? In that case, seeing that this bird's characters were in part those of the Blue-wing, in part those of the Golden-wing, he may have inferred the interbreeding of these two birds, and so (rather unwarrantably, it is true) their identity. If this be not the explanation of the passage in Audubon's letter to Bachman I have no other to suggest.

When Audubon came to publish his account of the Golden-winged Warbler in 1839 (*Ornithological Biography*, 1839, 5, p. 154) he said not a word about its connection with the Blue-winged Warbler.

PUBLICATIONS
OF THE
MUSEUM OF COMPARATIVE ZOÖLOGY
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There have been published of the BULLETIN Vols. I. to LII.; of the MEMOIRS, Vols. I. to XXIV., and also Vols. XXVI. to XXIX., XXXI. to XXXIV., XXXVII., XXXVIII., and XLI.

Vols. LIII. to LVII. of the BULLETIN, and Vols. XXV., XXX., XXXV., XXXVI., XXXIX., XL., XLII. to XLVIII., of the MEMOIRS, are now in course of publication.

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